

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

Elementary 3-5

Materials/Preparation

- ☐ Teacher Material A – Soil Composition and Particle Size – one per teacher
- ☐ Handout A – Soil Type Triangle – one per student
- ☐ Assessment A – It all Begins with Soil – one per student
- ☐ Soil from different locations, several cups per site
- ☐ Scales
- ☐ Artificial potting mix
- ☐ Potting soil
- ☐ Hand lenses and/or microscopes
- ☐ Paper
- ☐ Tweezers or other utensils to separate components
- ☐ Quart jars with lids
- ☐ Water
- ☐ Rulers
- ☐ Writing instruments
- ☐ Notebooks (can be individual or class lab notebooks)
- ☐ Soil samples (one per group of two or three students)

You may provide students with soil samples from different areas, or you can ask them to bring in samples from their homes. When taking a soil sample, it is best to select a site where soil has not been disturbed by building or other projects. Collect samples from home gardens or fields instead of a location right next to a home. After collecting a sample, label the location from which it was taken.

It All Begins with Soil

Minnesota K-12 Academic Standards

Science	3.1.1.2	Scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena.
Science	5.1.1.2	Scientific inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations.
Science	3.1.3.4 5.1.3.4	Tools and mathematics help scientists and engineers see more, measure more accurately, and do things that they could not otherwise accomplish.
Science	5.4.2.1	Natural systems have many parts that interact to maintain the living system.
Science	4.2.1.1	Objects have observable properties that can be measured.
Science	4.3.1.3	Rocks are Earth materials that may vary in composition.
Math	K.3.2	Compare and order objects according to location and measurable attributes.
Math	3.4.1	Collect, organize, display, and interpret data. Use labels and a variety of scales and units in displays.
Math	4.4.1	Collect, organize, display and interpret data, including data collected over a period of time and data represented by fractions and decimals.

Summary/Overview

Students examine soil samples to identify its components and differences between samples.

Garden Connection

Most of the produce we eat is grown in soil.

Background Information

Most of the foods we eat are grown in soil across the planet. These soils differ a great deal due to the rocks that eroded to create it, the temperature and temperature changes that occurred as it developed, rainfall and humidity present as it developed, and other factors. Soil types are determined by the composition of sand, silt, clay, and organic matter. Soil types affect the soil structure, ability to hold nutrients, water, air, structural support for plant roots, habitat suitability for animal and microbial life, and more. This activity is an introductory exploration for students. Soil science is very complicated. It is actually a science and there are careers in this field.

Objectives

- To recognize there are many components found in soil that determines soil type.
- To recognize there are different soil types and determine soil type found in the school garden site.

Procedure

Interest Approach

Ask the students what soil is. Answers will vary. Most commonly they will say that soil is dirt. Explain that dirt is an unwanted item where soil is not. Soil is very important. Soil becomes dirt when it is where you do not want it but dirt and soil are not interchangeable words, although they are often used as such. Ask students if they would like to eat plants grown in the dirt that is cleaned up from sweeping the floor or vacuuming. No, but much of that dirt can be recycled back into soil that can grow plants. Show students Teacher Material A. Discuss the components of soil as well as the size of particles found in the soil.

Summary of Content and Teaching Strategies

Soil Components Activity

Distribute soil samples to groups of two or three. Use a sample that is approximately a ½ cup. Students weigh the ½ cup and record the amount in a lab notebook. Save the balance of the sample collected. Ask them to identify the components they can find in the soil sample. Make a list. (Minerals, insects, worms, leaves, etc.) Ask them to separate out into separate piles the different components that are large enough to see with the naked eye.

Next have the students examine the remaining soil under the hand lens or microscope and separate additional components if possible. Add these to the appropriate piles. Once they are all separated, students weigh each component and record the weight in their lab notebooks.

Discuss and calculate the percentage of each component. Provide a place on the board for students to share their results. Discuss the class findings and explain that different soils will contain different components. Have them speculate what this may influence. As a class, choose one sample to create a pie graph of the components. Optional: If your students are older, you may wish to have each group graph their own sample.

Soil Type Activity

Have the students return the components to their soil sample less any rocks, pebbles or live insects and worms. Return any living animals to the garden. Place two cups of soil in a quart jar and fill the jar with water. (If soil samples are obviously different, put several samples in separate jars and repeat the activity.) As the water is added, students will see bubbles rising showing the air being forced out of the sample. Place the lid on tightly, and shake up the sample. Then place the jar(s) in a location where it will not be jostled to allow the soil to settle. This may happen quickly or take several days to settle completely. The water will be clear when the total sample has settled.

Fun Fact

Squash is technically a fruit because it contains the plant's seeds, but it is treated like a vegetable. In addition to the squash fruit, its seeds can be eaten directly, ground into paste, or (particularly for pumpkins) pressed for vegetable oil. The shoots, leaves, and tendrils can be eaten as greens. The blossoms are an important part of Native American cooking and are also used as food in many other parts of the world.



The particles have settled according to size with the largest and heaviest on the bottom and smallest and lightest on the top. Explain the layer closest to the bottom is the sand, the next layer is silt, and the top layer is clay. Above that will be any organic matter including dead insects and leaves that may be floating on the water surface.

Using a ruler, have the students measure the total of the three lowest layers and record the total number of inches. Then have students measure and record each of the layers in their lab notebook.

Have students calculate the percentage of each soil sample that is sand, silt, and clay. Using Handout A, students determine soil types. You may wish to select one sample and determine the soil type as a class. Younger students will need help drawing their lines on the triangle diagram.

Modifications/Extensions

Have students access <http://soils.usda.gov/use/thematic/> and <http://soils.usda.gov/use/worldsoils/gsr/> to examine soil issues in the United States and globally. Have them use this information to develop an opinion piece about the importance of soil to future world food production.

Download some soil type maps from sites such as these to examine a variety of soil maps and conditions (<http://soils.usda.gov/use/worldsoils/mapindex/index.html>) and a comparison of soil types in Russia (http://www.agroatlas.ru/en/content/soil_maps/Soil_types/).

Have students access the Detailed Soil Survey Atlas and examine soil productivity for Minnesota at http://www.ngdc.wvu.edu/soil_survey_atlas/subpage_3 and write a short essay on Minnesota soils, their strengths, and weaknesses.

Review/Summary

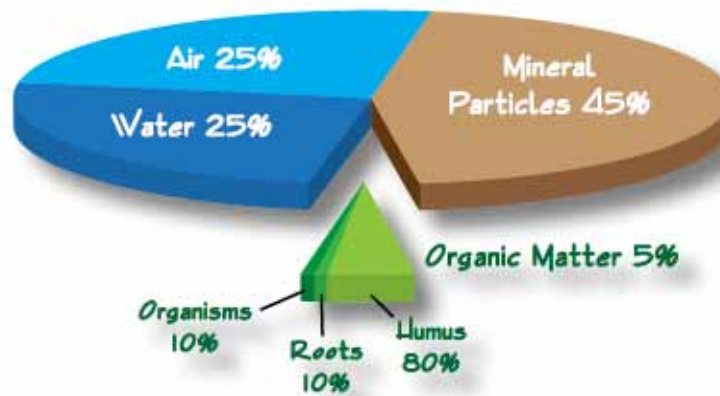
Have the students collect soil samples from around the schoolyard and repeat the process to determine soil type.



Sources/Credits

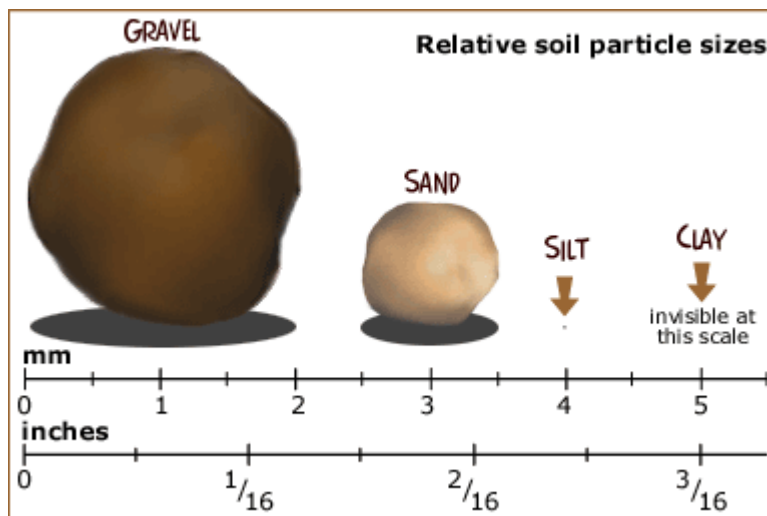
This lesson is provided courtesy of Florida Agriculture in the Classroom, Inc. from its Gardening for Grades school garden curriculum.

Soil composition and Particle Size



Pie Graph of Soil Composition

Source: www.physicalgeography.net/fundamentals/10t.html, accessed July 25, 2010



Source:

http://school.discoveryeducation.com/schooladventures/soil/name_soil.html

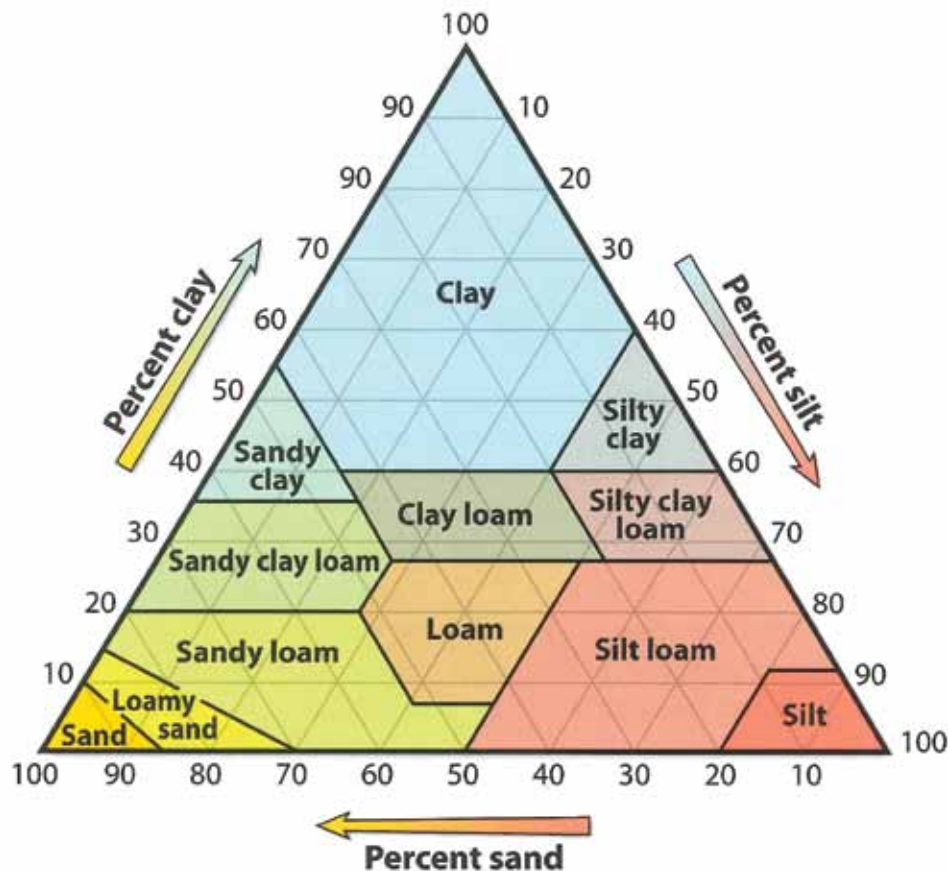


Soil Type Triangle

1. First find the percentage of clay in the soil sample along the clay side of the graph triangle. Using a ruler, draw a line across the graph parallel to the other percentage lines for clay.
2. Next find the percent of sand along the sand side of the triangle and draw a line across the graph parallel to the other percentage lines for sand.
3. Third, find the percentage of silt along the silt side of the triangle and draw a third line parallel to the percentage lines of silt.

The intersection of these three lines on the graph will fall within a soil type.

Write down your type of soil.



Name _____

It All Begins With Soil



1. Soil is made of:

2. The process for creating soil begins with _____.

- a. the weathering of rocks
- b. the ocean
- c. sandy beaches
- d. microorganisms

3. Soils differ around the world because:

4. List the mineral components of soil in order of largest to smallest:

5. Soil is alive.

☐ True ☐ False